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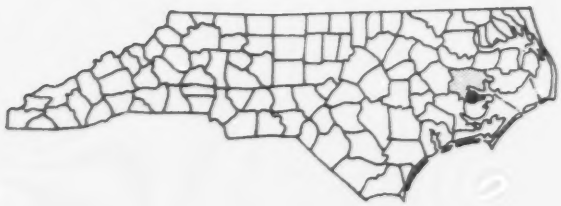
COMPLETED

FLOOD INSURANCE STUDY

ORIGINAL

CITY OF AURORA,
NORTH CAROLINA
BEAUFORT COUNTY



JANUARY 3, 1986

Federal Emergency Management Agency

COMMUNITY NUMBER - 370014

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TABLE OF CONTENTS

		Page
1.0	INTRODUCTION	1
1.1	Purpose of Study	1
1.2	Authority and Acknowledgements	1
1.3	Coordination	1
2.0	AREA STUDIED	2
2.1	Scope of Study	2
2.2	Community Description	2
2.3	Principal Flood Problems	4
2.4	Flood Protection Measures	7
3.0	ENGINEERING METHODS	7
3.1	Hydrologic Analyses	7
3.2	Hydraulic Analyses	8
4.0	FLOODPLAIN MANAGEMENT APPLICATIONS	12
4.1	Flood Boundaries	12
4.2	Floodways	13
5.0	INSURANCE APPLICATIONS	16
5.1	Reach Determinations	16
5.2	Flood Hazard Factors	16
5.3	Flood Insurance Zones	17
5.4	Flood Insurance Rate Map Description	17
6.0	OTHER STUDIES	20
7.0	LOCATION OF DATA	20
8.0	BIBLIOGRAPHY AND REFERENCES	20

FIGURES

Figure 1 - Vicinity Map 3
Figure 2 - Floodway Schematic 15

TABLES

Table 1 - Summary of Discharges 9
Table 2 - Parameter Values for Surge Elevation 10
Table 3 - Floodway Data 14
Table 4 - Coastal Flood Insurance Zone Data 18
Table 5 - Flood Insurance Zone Data 19

BEST COPY AVAILABLE

TABLE OF CONTENTS
(continued)

EXHIBITS

Flood Profiles:

Bailey Creek Profile 01P

Flood Boundary and Floodway Map Index

Flood Boundary and Floodway Map

PUBLISHED SEPARATELY

Flood Insurance Rate Map Index

Flood Insurance Rate Map

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FLOOD INSURANCE STUDY
CITY OF AURORA
BEAUFORT COUNTY
NORTH CAROLINA

1.0 INTRODUCTION

1.1 Purpose of Study

This Flood Insurance Study investigates the existence and severity of flood hazards in the City of Aurora, Beaufort County, North Carolina, and aids in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. This study will be used to convert the City of Aurora to the regular program of flood insurance by the Federal Emergency Management Agency (FEMA). Local and regional planners will use this study in their efforts to promote sound floodplain management.

In some states or communities, floodplain management criteria or regulations may exist that are more restrictive or comprehensive than those on which these Federally supported studies are based. These criteria take precedence over the minimum Federal criteria for purposes of regulating development in the floodplain, as set forth in the Code of Federal Regulations at 44 CFR, 60.3 (c&d). In such cases, however, it shall be understood that the state (or other jurisdictional agency) shall be able to explain these requirements and criteria.

1.2 Authority and Acknowledgements

The source of authority for this Flood Insurance Study is the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973.

The hydrologic and hydraulic analyses for this study were performed by Tetra Tech, Inc. (Study Contractor) for the Federal Emergency Management Agency, under Contract No. EMW-C-0344. This study was completed in January, 1983.

1.3 Coordination

The following organizations were contacted for coordination in the development of this study:

City of Aurora, North Carolina
County of Beaufort, North Carolina
Eastern Mapping Center, U.S. Geological Survey, Reston, Virginia
North Carolina Department of Transportation
North Carolina Geodetic Survey
U.S. Army Corps of Engineers, Wilmington, North Carolina
U.S. Department of Agriculture, Soil Conservation Service
U.S. Department of Commerce, Bureau of the Census

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The State Coordinator was involved with this study through the Region IV Office of the Federal Emergency Management Agency.

On August 28, 1984, the results of this study were reviewed at a final coordination meeting attended by representatives of the study contractor, FEMA, and community officials. The study was acceptable to the community.

2.0 AREA STUDIED

2.1 Scope of Study

This Flood Insurance Study covers the incorporated and extra-territorial jurisdiction areas of the City of Aurora. The area of study is shown on the Vicinity Map (Figure 1). This detailed study analysis includes coastline flooding due to hurricane induced storm surge. Both the open coast surge and its inland propagation were studied.

The Atlantic Ocean, Bailey Creek, Pamlico Sound, and South Creek are the only flooding sources in Aurora that were studied by detailed methods. The areas studied by detailed methods were selected with priority given to all known flood hazard areas, and areas of projected development or proposed construction for the next five years, through January, 1988.

Approximate analyses were used to study those areas having a low development potential of minimal flood hazards. The scope and methods of study were proposed to and agreed upon by the Federal Emergency Management Agency and the City of Aurora.

2.2 Community Description

The City of Aurora is located along the western shore of South Creek, just south of the Pamlico River in southern Beaufort County, eastern North Carolina and is surrounded by the unincorporated areas of Beaufort County. The City lies to the south of Bath and Belhaven and to the southeast of Washington and Washington Park. The City is primarily a residential community, with some agricultural and manufacturing industries located within the City limits (Reference 1).

The 1970 U.S. Bureau of the Census recorded the population of Aurora at 620; the 1980 Census recorded the population at 698, an increase of 13 percent from the 1970 figure (Reference 2).

The City of Aurora occupies relatively flat land, with elevations ranging between sea level and 15 feet above the National Geodetic Vertical Datum (NGVD). Wetlands border South Creek in the eastern section of the City, and Bailey Creek in the northern section. Forested land exists in the City's eastern and northern portions. Within the City, large portions of land are set aside for agricultural, residential, and commercial purposes (References 1).

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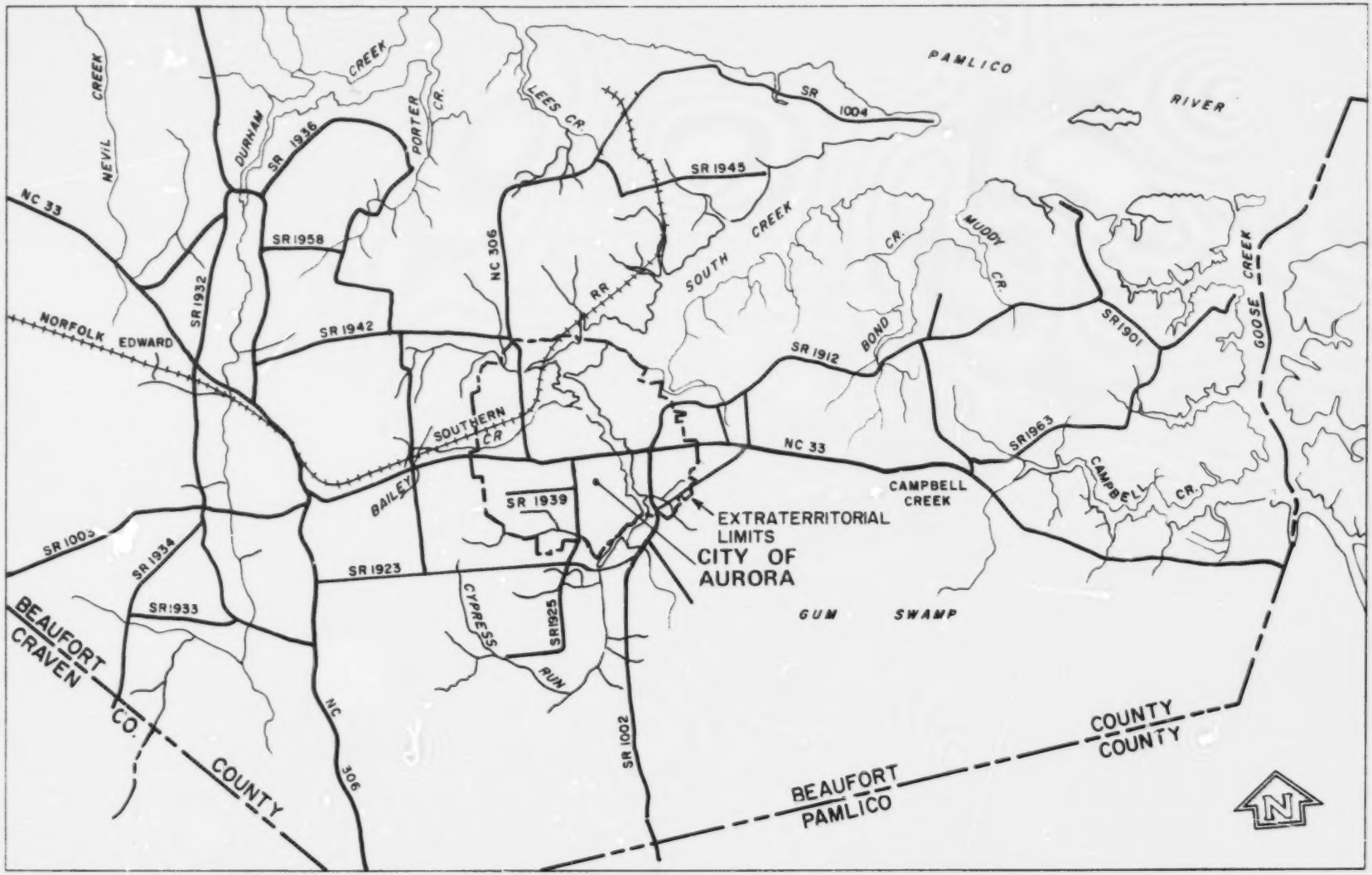

FIGURE 1

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF AURORA, NC
(BEAUFORT CO)

APPROXIMATE SCALE

2 0 2 4 6 MILES

VICINITY MAP

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Aurora's climate is characterized by mild winters and warm summers. The mean annual temperature in the study area ranges between 60 and 65 degrees fahrenheit (Reference 3). The average annual rainfall in the study area is approximately 53 inches (Reference 1).

The Bladen-Bayboro-Portsmouth Association is the only soil association in Aurora. This soil is poorly drained to very poorly drained with dark gray to black surfaces and friable to firm subsoils of the lower marine terraces (Reference 4). This soil association is classified in Soil Conservation Service Group D (Reference 5).

2.3 Principal Flood Problems

The dominant source of flooding in Aurora is storm surge generated in the Atlantic Ocean by tropical storms and hurricanes. This storm surge propagates into Pamlico Sound, and propagates further into Bailey Creek, Pamlico River, and South Creek. In addition, heavy rainfall occurs on Bailey Creek. Not all storms which pass close to the study area produce extremely high surge. Similarly, storms which produce flooding conditions in one area may not necessarily produce flooding conditions in other parts of the study area.

North Carolina experiences hurricanes, tropical storms, and severe extratropical cyclones usually referred to as northeasters. Unlike a hurricane which may pass over a coastal location in a fraction of a day, a northeaster may blow from the same direction and over long distances for several days (Reference 6). The contribution from northeasters to the overall storm surge elevation in the Aurora area was found to be insignificant compared to hurricanes; therefore, only the effects of hurricane and tropical storm induced surge elevations were considered. In other areas of North Carolina, particularly the Outer Banks area of the northern part of the State, northeasters were found to provide a significant contribution to the overall storm surge.

Storms passing North Carolina in the vicinity of Aurora have produced severe floods as well as structural damage. Brief descriptions of several significant storms provide historical information to which coastal flood hazards and flood depths can be compared (Reference 7).

October 5 to 18, 1954 (Hurricane Hazel)

Hurricane Hazel was the most destructive storm in the history of North Carolina. The storm crossed the coast just north of Myrtle Beach, South Carolina, as hurricane winds hit the Atlantic coast between Georgetown, South Carolina, and Cape Lookout, North Carolina. Storm tides (i.e. hurricane surge) devastated the immediate ocean front of this stretch of coast. Every fishing pier along 170 miles of coast, from Myrtle Beach, South Carolina to Cedar Island, North Carolina, was destroyed. The waterfront

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between the South Carolina - North Carolina state line and Cape Fear was completely destroyed. Grass-covered dunes, some 20 feet high, along and behind which beach homes had been built in a continuous line 5 miles long, simply disappeared - dunes, houses, and all. From Cape Fear to Cape Lookout the degree of devastation was not as great, but ocean front property was damaged an average of 50 percent along this entire stretch. North of Cape Lookout damage was relatively light.

Storm surge of 16.6 feet above National Geodetic Vertical Datum (NGVD) was observed at Holden Beach Bridge and Calabash, North Carolina. The lowest recorded barometric pressure of the storm was 938 millibars (mb), reported at Little River Inlet on the North Carolina - South Carolina border. Maximum wind speeds were 83 mph, with gusts recorded at 98 mph at Wilmington, North Carolina; 106 mph at Myrtle Beach, South Carolina; and an estimated 150 mph at Cape Fear. The storm continued inland through North Carolina causing widespread damage due to high winds and record rainfall. Nineteen people were killed and 200 injured during this storm.

August 3 to 14, 1955 (Hurricane Connie)

Hurricane Connie entered North Carolina close to Cape Lookout at about 8:30 a.m. on August 12. The prolonged pounding of high waves against the coast caused tremendous beach erosion, probably worse than that caused by Hazel in 1954. Storm tides along the coast from Southport to Nags Head were reported to be about 7 feet NGVD (6.9 feet NGVD at Wrightsville Beach and 7.5 feet NGVD at Kure Beach). Water in sounds and near the mouths of rivers was 5 to 8 feet above normal. At Wilmington, winds were reported at 72 mph, gusting to 83 mph. At Fort Macon, winds of 75 mph, gusts of 100 mph, and a barometric pressure of 962 mb were reported. The storm also brought torrential rains with the maximum rainfall, around 12 inches in 48 hours, occurring near Morehead City. Total damage throughout the State was estimated at $50 million.

August 7 to 21, 1955 (Hurricane Diane)

Five days after Hurricane Connie, and before the damage from that storm could be estimated, Hurricane Diane struck the coast near Carolina Beach about 6 a.m. on August 17. The highest wind speed reported during this storm was 74 mph at Wilmington Airport. Storm tides ranged from 5 to 9 feet above mean low water on the beaches (6.8 feet NGVD at Wrightsville Beach), and in some areas of sounds and rivers emptying into sounds, estimated water levels were 5 to 9 feet above normal. Water was 3 feet above floor level in the business district of Belhaven and "waist deep" in parts of Washington and New Bern. Diane caused severe beach erosion along the North Carolina coast. The total damage caused in North Carolina by Connie and Diane was estimated to be in excess of $90 million. No deaths or injuries in North Carolina were attributed to either of the storms.

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September 10 to 23, 1955 (Hurricane Ione)

Hurricane Ione moved up from the south and crossed the North Carolina coast near Salter Path, 10 miles west of Morehead City, at about 5 a.m. on September 19. It then slowly curved to the northeast and went out to sea near the Virginia border early on September 20. When Ione entered North Carolina, winds gusted to over 100 mph. Wind speeds of 75 mph with gusts to 107 mph were recorded at Cherry Point. The minimum barometric pressure recorded over North Carolina during this storm was 960 mb. Heavy rains also accompanied Ione. At the same time, prolonged easterly winds drove tidal water onto beaches and into sounds and estuaries to heights of 3 to 10 feet above normal. The result was the largest inundation of eastern North Carolina ever known to have occurred. At New Bern, the depth of the flood was the greatest ever recorded, about 10.5 feet above mean low water; forty city blocks were flooded, several hundred homes were washed away, and thousands more were flooded with up to 4 feet of water. A high tide of 6.9 feet NGVD was reported at Atlantic Beach, North Carolina, and an estimated 5.3 feet NGVD at Wrightsville Beach.

September 21 to October 3, 1958 (Hurricane Helene)

Hurricane Helene was one of the most powerful storms of recent history; fortunately for the people of North Carolina, the storm center was well out at sea as it moved north on September 26 and 27. Nevertheless, high winds were recorded at Wilmington, with the highest winds measured at 85 mph and peak gusts recorded at 135 mph. The lowest reported central pressure of the storm was 932 mb; this measurement was recorded south-southeast of Cape Fear early on the morning of the 27th. There was some beach erosion due to seas and tides, but this erosion was minimized by the fact that the storm occurred at a time of low astronomical tides. High tides were estimated at 3 to 5 feet above normal; a high tide of 5.1 feet NGVD was reported at Wrightsville Beach. Tides were higher on the southern edge of Pamlico Sound, when the wind shift as the storm center passed brought the tides 7 to 8 feet above normal.

August 29 to September 13, 1960 (Hurricane Donna)

Hurricane Donna crossed the North Carolina coast between Wilmington and Morehead City on September 11. The center of the storm passed a few miles east of Wrightsville Beach, although Wilmington and Wrightsville Beach were each in the eye for about an hour. The lowest barometric pressure recorded during this storm was 962 mb at Wilmington. High tides, 6 to 8 feet above normal, together with high winds, caused severe damage at many points. Winds of hurricane force, up to 97 mph, were reported from Wilmington.

During the night of September 11, the storm center moved northward, parallel and slightly east of a line drawn between Wilmington and Norfolk. Wind gusts were in excess of 97 mph and

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tides were 4 to 8 feet above normal. High tides of 10.3 and 8.3 feet NGVD were reported at Atlantic Beach and Wrightsville Beach, respectively. Coastal communities from Wilmington to Nags Head suffered heavy structural damage and considerable beach erosion. Eight deaths and approximately 100 injuries were attributed to the storm. Damages were estimated at millions of dollars.

2.4 Flood Protection Measures

There are no structural flood protection measures in the City of Aurora (Reference 8).

The only notable nonstructural flood protection measure is the Public Warning System for severe weather conditions operated by the National Oceanic and Atmospheric Administration, through the National Weather Service in cooperation with various state, county, and local officials. This system can provide some measure of flood protection by alerting coastal residents to take the necessary precautions in the event of a major storm.

3.0 ENGINEERING METHODS

For flooding sources studied in detail in the community, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this study. Flood events of a magnitude which are expected to be equalled or exceeded once on the average during any 10, 50, 100, or 500 year period (recurrence interval) have been selected as having special significance for floodplain management and for insurance premium rates. These events, commonly termed the 10, 50, 100, and 500 year floods, have a 10, 2, 1, and 0.2 percent chance, respectively, of being equalled or exceeded during any year. Although the recurrence interval represents the long term average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than one year are considered. For example, the risk of having a flood which equals or exceeds the 100-year flood (one percent chance of annual occurrence) in any 50 year period is about 40 percent (four in ten), and for any 90 year period, the risk increases to about 60 percent (six in ten). The analyses reported here reflect flooding potentials based on conditions existing in the community at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

3.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish the peak elevation-frequency relationships for floods of the selected recurrence intervals for each flooding source studied in detail affecting the City.

Regionalized regression equations developed by the U.S. Army Corps of Engineers were used as the basis for computing the discharges

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for watersheds that drain less than 200 square miles (Reference 9). In the coastal regions of North Carolina, these equations provide discharge values of given recurrence intervals as a function of drainage area. Where urbanization within a drainage basin has occurred, the methodology specified in a U.S. Geological Survey publication (Reference 10) was used to adjust the discharges derived from the Corps report. The resulting estimated peak discharges for the selected frequencies of each of the streams studied in detail are shown in Table 1, "Summary of Discharges."

Coastal inundation above the usual astronomic tide level from the Atlantic Ocean, caused by the passage of storms (storm surge), was determined using the joint probability method (Reference 11). The storm populations were described by probability distributions of five parameters that influence surge heights. These five parameters are central pressure depression (which measures the intensity of the storm), radius to maximum winds, forward speed of the storm, shoreline crossing point, and crossing angle. These characteristics were described statistically based on an analysis of storms that have passed near the southern coast of North Carolina. Primary sources of data for these analyses were the National Weather Service and the Mariners Weather Log. The National Weather Service provided information on tropical cyclones of the North Atlantic Ocean from 1871 to 1977, and on storms from 1886 through 1979 (References 12, 13, and 14). The Mariners Weather Log provided information on North Atlantic Tropical Cyclones in 1978 and 1979 (References 15 and 16). A summary of the parameters used for the Aurora area is presented in Table 2, "Parameter Values for Surge Elevation."

3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of the flooding sources studied in detail in the City were carried out to provide estimates of the elevations of floods of the selected recurrence intervals along each of these flood sources.

Channel roughness factors (Manning's "n") used in the hydraulic computations were chosen on the basis of field observations, aerial photographs of the streams and floodplain areas, and the U.S. Geological Survey's Water Supply Paper 1849 (Reference 17). Roughness values used for the streams ranged from 0.03 to 0.06; the overbank floodplain roughness values were set at 0.2.

Normal depth calculations were used to set the starting water surface elevation for all the streams studied. Independent computations were performed to determine flood levels along the rivers resulting from either coastal flooding or rainfall. The results of each computation were combined statistically to obtain flood levels for each return period using a method specified in the Coastal Flooding Storm Surge Model (Reference 18).

A flood profile was drawn for Bailey Creek displaying computed water surface elevations to an accuracy of 0.5 foot for floods of

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FLOODING SOURCE AND LOCATION	DRAINAGE AREA (SQ MILES)	PEAK DISCHARGES (CFS)			
		10-YEAR	50-YEAR	100-YEAR	500-YEAR
Bailey Creek 3,400 feet upstream of confluence with South Creek	5.9	603	1,196	1,549	2,268
South Creek at NC 33	32.5	1,640	3,080	3,910	6,415

TABLE 1

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF AURORA, NC
(BEAUFORT CO)

SUMMARY OF DISCHARGES

BAILEY CREEK, SOUTH CREEK

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Central Pressure Depression (milfibars)	5	15	25	35	45	55	65	75	85
Probabilities:*									
I:	0.079	0.079	0.079	0.144	0.218	0.215	0.112	0.056	0.016
II:	0.185	0.185	0.185	0.144	0.107	0.105	0.055	0.028	0.008
III:	0.238	0.238	0.238	0.143	0.050	0.050	0.026	0.013	0.004

Storm Radius to maximum winds (nautical miles)		20		35	
Probability		0.51		0.49	

Maximum Forward Speed (Knots)		10	20	30	
Probabilities:					
I:		0.700	0.250	0.050	
II:		0.551	0.306	0.143	
III:		0.463	0.370	0.167	

Crossing Angle (degrees)**	276	312	348	24	60
Probability	0.033	0.041	0.089	0.398	0.439
Rate (storms/nautical miles/year)	$0.18(10^{-3})$	$0.19(10^{-3})$	$0.41(10^{-3})$	$2.17(10^{-3})$	$1.94(10^{-3})$

* I: Used for crossing angles 276°, 312°, 348°.
II: Used for crossing angle 24°.
III: Used for crossing angle 60°.

**Direction of forward motion, measured positive clockwise from true north.

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF AURORA, NC
(BEAUFORT CO)

PARAMETER VALUES FOR SURGE ELEVATION

NORTH CAROLINA COASTLINE SOUTH OF HATTERAS INLET

the selected recurrence intervals. For those stream segments in which a floodway is computed, selected cross section locations are shown on the Flood Boundary and Floodway Map.

For areas subject to stream overflow, water surface elevations for floods of the selected recurrence intervals were developed using the U.S. Army Corps of Engineers HEC-2 water surface profile computer model (References 19 and 20). Cross sections for the backwater analyses were obtained from field surveys. In some cases, U.S. Geological Survey topographic maps (Reference 21) were used to extend surveyed cross sections. All bridges, dams, and culverts were field checked to obtain elevation data and structural geometry.

For areas subject to flooding directly from the Atlantic Ocean, the Federal Emergency Management Agency's standard coastal surge model was used to simulate the coastal surge generated by any chosen storm (that is, any combination of the five storm parameters previously defined). Performing such simulations for a large number of storms, each of known total probability, permits one to establish the frequency distribution of surge height as a function of coastal location. These distributions incorporate large scale surge behavior, but do not include an analysis of the added effects associated with much finer scale wave phenomena such as wave height, set up, or run up. The astronomic tide for the region is then statistically combined with the computed storm surge to yield recurrence intervals of total water level (Reference 18).

The surge model uses grid patterns that approximate the geographical features of the study area. Simulations were first performed for the Aurora area using an open coast grid having an element size of 5 nautical miles (nm). Surge is then propagated through a second 2 nm grid covering an extensive portion of coastal North Carolina, including the outer barrier islands and the entire Pamlico Sound system. The finer grid, with an element size of 1 nm, adequately represented conditions (through model calibration/verification runs) in the study area (Reference 18).

Although northeasters (winter storms) are more diffuse and less intense than hurricanes, they occur more frequently and cover larger areas and longer coastal reaches at one time. The effects of northeasters were analyzed through a two step procedure. The first step was to perform a statistical analysis of the tide gauge data for winter storms at Hampton Roads, Virginia. The second was to develop a spatial correlation of the northeaster induced water elevations between Hampton Roads and each of the selected locations along the coast of the study through numerical model simulations.

The northeaster analysis led to two significant conclusions. First, the effects of northeasters on the 100-year storm surge elevations are significant only along the ocean side of the Outer

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Bank areas north of Cape Hatteras. Second, the effects are most significant in Currituck County where northeasters typically contribute between 1 and 1.5 feet to the 10-year surge elevations and generally less than 0.5 foot to the 100-year surge elevations. These contributions refer to the added effects of northeasters above surge computations which consider only the effects of hurricanes and other tropical storms plus astronomical tides.

The hydraulic analyses for this study were based on unobstructed flow. The flood elevations are thus considered valid only if hydraulic structures remain unobstructed, operate properly, or do not fail.

Data for the model grid systems were obtained from U.S. Geological Survey quadrangle sheets (Reference 21), National Oceanic and Atmospheric Administration nautical charts (Reference 22), and from aerial photographs (Reference 23). The results of this study are considered accurate until local topography, vegetation, or cultural development undergo any major changes. The computed coastal surge elevations were combined with elevations computed for riverine flood sources using the joint probability method (Reference 11). (The combined values appear in the "Regulatory Base Flood Elevations" column in Table 3.) The computed coastal surge elevations for the Aurora area are listed in Table 4 "Coastal Flood Insurance Zone Data" (see Section 5.3).

No wind wave analyses were performed for the City of Aurora. Wave height analyses were not performed in the study area because it was determined that it would be unlikely the 100-year wave height would occur coincident with the 100-year surge elevation. In accordance with the current FEMA guidelines, it is recognized that wave hazards which may exist in certain areas will not be reflected in the study or maps.

All elevations are referenced to the National Geodetic Vertical Datum (NGVD) of 1929. Elevation reference marks used in this study are shown on the maps.

4.0 FLOODPLAIN MANAGEMENT APPLICATIONS

The National Flood Insurance Program encourages state and local governments to adopt sound floodplain management programs. Therefore, each Flood Insurance Study includes a flood boundary map designed to assist communities in developing sound floodplain management measures.

4.1 Flood Boundaries

In order to provide a national standard without regional discrimination, the 100-year flood has been adopted by the Federal Emergency Management Agency as the base flood for purposes of floodplain management measures. The 500-year flood is employed to indicate additional areas of flood risk in the City.

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For each stream studied in detail, the boundaries of the 100- and 500-year flood levels have been delineated using topographic maps with a scale of 1:24,000 with a contour interval of 5 feet (Reference 21). Aerial photographs at a scale of 1:24,000 were used as aids (Reference 23).

Flood boundaries are indicated on the Flood Insurance Rate Map. On this map, the 100-year flood boundary corresponds to the boundary of the special flood hazard area (Zones A4 and A5), and the 500-year flood boundary corresponds to the boundary of the moderate flood hazard area (Zone B). In cases where the 100- and 500-year flood boundaries are approximately the same, only the 100-year flood boundary has been shown.

Small areas within the flood boundaries may lie above the flood elevations, and therefore may not be subject to flooding. Owing to the limitations of the map scale, such areas are not shown.

4.2 Floodways

Encroachments on floodplains, such as artificial fills, reduce the flood-carrying capacity and add to flood heights, thus increasing flood hazards in areas beyond the encroachment itself. One aspect of floodplain management involves balancing the economic gain from floodplain development against the resulting increase in flood hazard. For purposes of the National Flood Insurance Program, the concept of a floodway is used as a tool to assist local communities in this aspect of floodplain management. Under this concept, the area of the 100-year flood is divided into a proposed floodway and a floodway fringe. The floodway is the channel of a stream, plus any adjacent floodplain areas, that must be kept free of encroachment in order that the 100-year flood be carried without substantial increases in flood heights. As minimum standards, the Federal Emergency Management Agency limits such increases in flood heights to one foot in areas studied, provided that hazardous velocities are not produced.

The floodways proposed in this study for riverine areas were computed on the basis of equal conveyance reduction from each side of the floodplain. Floodways were not tabulated or delineated for South Creek because the floodway matches the stream banks within the City limits. Floodways are not delineated in coastal high hazard areas (velocity zones). The computation of floodways on rivers in coastal floodplains is based on increasing the computed 100-year rainfall flooding level. The results of these computations are tabulated at selected cross sections for each stream studied in detail, as shown in Table 3, "Floodway Data."

The surcharge identified in Figure 2, "Floodway Schematic," and tabulated in the last column of Table 3, represents the maximum 100-year water level increase that is permitted with encroachment. The tabulated values are the maximum increases in water level for the reaches studied such that the maximum water level increase in areas considered anywhere upstream does not exceed one foot.

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FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQ FT.)	MEAN VELOCITY (F.P.S.)	REGULATORY (NGVD)	WITHOUT FLOODWAY (NGVD)	WITH FLOODWAY (NGVD)	INCREASE (FEET)
Bailey Creek								
A	0	96	505	3.1	7.6	3.4[2]	4.4	1.0
B	1,600	73	426	3.6	7.6	5.9[2]	6.9	1.0
C	3,993	242	1,460	1.1	8.2	8.2	9.2	1.0
D	6,173	594	4,838	0.3	8.5	8.5	9.5	1.0

1 Stream distance in feet above corporate limits.

2 Elevations computed without considering storm surge effects from the Atlantic Ocean.

TABLE 3

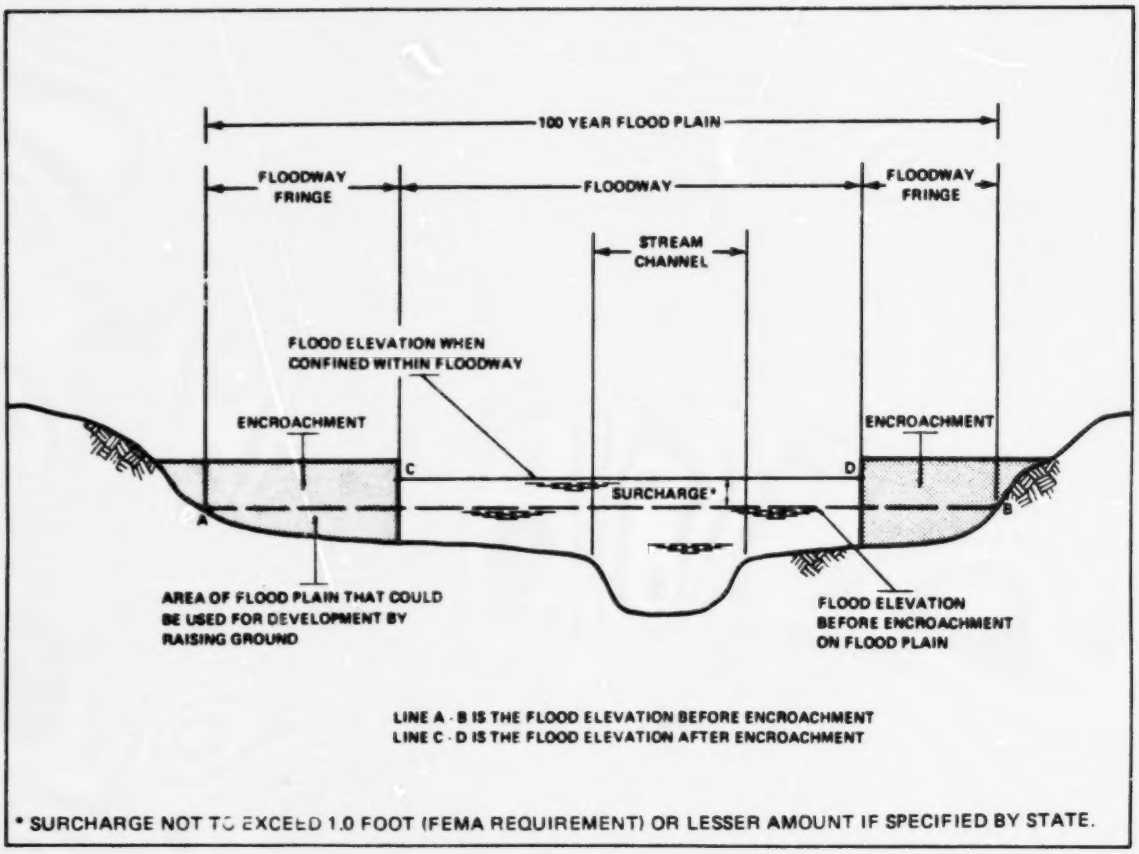
FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF AURORA, NC
(BEAUFORT CO)

FLOODWAY DATA

14

BAILEY CREEK


100 YEAR FLOOD PLAIN
FLOODWAY FRINGE
FLOODWAY
FLOODWAY FRINGE
STREAM CHANNEL
FLOOD ELEVATION WHEN CONFINED WITHIN FLOODWAY
ENCROACHMENT
ENCROACHMENT
C
D
SURCHARGE*
A
B
AREA OF FLOOD PLAIN THAT COULD BE USED FOR DEVELOPMENT BY RAISING GROUND
FLOOD ELEVATION BEFORE ENCROACHMENT ON FLOOD PLAIN
LINE A - B IS THE FLOOD ELEVATION BEFORE ENCROACHMENT
LINE C - D IS THE FLOOD ELEVATION AFTER ENCROACHMENT
* SURCHARGE NOT TO EXCEED 1.0 FOOT (FEMA REQUIREMENT) OR LESSER AMOUNT IF SPECIFIED BY STATE.

FLOODWAY SCHEMATIC Figure 2

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As shown on the Flood Boundary and Floodway Map, the floodway boundaries were determined at cross sections; between cross sections, the boundaries were interpolated.

The area between the floodway and the boundary of the 100-year flood is termed the floodway fringe. The floodway fringe thus encompasses the portion of the floodplain that could be completely obstructed without increasing the water surface elevation of the 100-year flood more than one foot at any point in the area studied. Typical relationships between the floodway and the floodway fringe, and their significance to floodplain development, are shown in Figure 2.

5.0 INSURANCE APPLICATIONS

In order to establish actuarial insurance rates, the Federal Emergency Management Agency has developed a process to transform the data from the engineering study into flood insurance criteria. This process includes the determination of reaches, Flood Hazard Factors (FHF), and the flood insurance zone designations for each flooding source affecting the City.

5.1 Reach Determinations

Reaches are defined as lengths of watercourses or waterbodies having relatively the same flood hazard, based on the average weighted difference in water surface elevations between the 10- and 100-year floods. This difference should not have a variation greater than that indicated in the following table for more than 20 percent of the reach:

Average Difference Between 10- and 100-Year Floods	Variation
Less than 2 feet	0.5 foot
2 to 7 feet	1.0 foot

In lacustrine or tidal areas, reaches are limited to the distance for which the 100-year flood elevation does not vary more than 1.0 foot. Using these criteria, 2 reaches were required for the flooding sources of Aurora. The location of these reaches are shown on the Flood Insurance Rate Map.

5.2 Flood Hazard Factors

The Flood Hazard Factor (FHF) is used to correlate flood information with insurance rate tables. Correlations between property damage from floods and their assigned FHFs are used to set actuarial insurance premium rate tables based on FHFs from 005 to 200.

The FHF for a reach is the average weighted difference between the 10- and 100-year flood water surface elevations, expressed to the nearest one-half foot, and shown as a three digit code. For example, if the difference between water surface elevations of the

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10- and 100-year floods is 0.7 foot, the FHF is 005; if the difference is 1.4 feet, the FHF is 015; if the difference is 5.0 feet, the FHF is 050. When the difference between the 10- and 100-year water-surface elevations is greater than 10.0 feet, the accuracy of the FHF is to the nearest foot.

The numbered A Zone designations are determined by calculating the average difference between the 100-year stillwater elevation and the 10-year stillwater elevation for each zone. These differences are rounded to the nearest half foot to denote the FHF.

5.3 Flood Insurance Zones

After determining the reaches and their respective FHFs, the entire incorporated area of the City of Aurora was divided into zones, each having a specific flood potential or hazard. Each zone was assigned one of the following flood insurance zone designations:

Zone A: Special Flood Hazard Areas inundated by the 100-year flood, determined by approximate methods; no base flood elevations shown or flood hazard factors determined.

Zones A4 & A5: Special Flood Hazard Areas inundated by the 100-year flood, determined by detailed methods; base flood elevations shown, and zones subdivided according to Flood Hazard Factors.

Zone B: Areas between the Special Flood Hazard Area and the limits of the 500-year flood; areas that are protected from the 100-year or 500-year flood by dike, levee, or other water control structure; areas subject to certain types of 100-year shallow flooding where depths are less than 1.0 foot; and areas subject to 100-year flooding from sources with drainage areas less than 1 square mile. Zone B is not subdivided.

Zone C: Areas of minimal flooding.

Table 4 "Coastal Flood Insurance Zone Data," and Table 5 "Flood Insurance Zone Data," summarize the flood elevations, FHFs, flood insurance zones, and base flood elevations for the flooding sources studied in detail within the City.

5.4 Flood Insurance Rate Map Description

The Flood Insurance Rate Map for Aurora is, for insurance purposes, the principal result of the Flood Insurance Study. This map (published separately) contains the official delineation of flood insurance zones and base flood elevation lines. Base flood elevation lines show the locations of the expected whole-foot water surface elevation of the base (100-year) flood. This map was developed in accordance with the latest flood insurance map preparation guidelines published by the Federal Emergency Management Agency.

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FLOODING SOURCE	PANEL[1]	TRANSECTS	STILLWATER ELEVATIONS				FLOOD HAZARD FACTOR	ZONE	BASE FLOOD[2,3,4] ELEVATION FEET (NGVD)
			10 YEAR	50 YEAR	100 YEAR	500 YEAR			
Atlantic Ocean/ Pamlico River/ South Creek/ Bailey Creek	0001,0002 0003,0004	N/A	5.6	7.2	7.7	8.8	020	A4	8
	0002	N/A	5.5	7.4	7.9	9.1	025	A5	8

[1] FLOOD INSURANCE RATE MAP PANEL (FIRM)
[2] ROUNDED TO NEAREST FOOT
[3] DUE TO MAP SCALE LIMITATIONS, BASE FLOOD ELEVATIONS (BFEs) SHOWN ON THE FIRM MAY REPRESENT AVERAGE ELEVATIONS FOR THE ZONES DEPICTED
[4] MINIMUM AND MAXIMUM WAVE CREST ELEVATIONS, WHERE APPLICABLE

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF AURORA, NC
(BEAUFORT CO.)

COASTAL FLOOD INSURANCE ZONE DATA

ATLANTIC OCEAN/PAMLICO RIVER/SOUTH CREEK/BAILEY CREEK

FLOODING SOURCE	PANEL[1]	ELEVATION DIFFERENCE BETWEEN BASE FLOOD AND:[2,3]			FLOOD HAZARD FACTOR	ZONE	BASE FLOOD ELEVATION[4] FEET (NGVD)
		10% (10 YR.)	2% (50 YR.)	0.2% (500 YR.)			
Bailey Creek	0001	-2.1	-0.6	1.4	020	A4	8

[1] FLOOD INSURANCE RATE MAP PANEL (FIRM)
[2] WEIGHTED AVERAGE
[3] BASED UPON STILLWATER ELEVATION DIFFERENCES
[4] ROUNDED TO NEAREST FOOT

TABLE 5

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF AURORA, NC
(BEAUFORT CO)

FLOOD INSURANCE ZONE DATA

BAILEY CREEK

6.0 OTHER STUDIES

No previous Flood Insurance Studies have been prepared for the City of Aurora. Some flood related studies that concern the study area include the Storm Tide Frequency Analysis for the North Carolina Coast by the National Oceanic and Atmospheric Administration (Reference 24); and the National Shoreline Study by the U.S. Army Corps of Engineers (Reference 25).

A Flood Insurance Study for the Unincorporated Areas of Beaufort County is in progress (Reference 26), and when complete, will be in agreement with this study.

Due to its more detailed analysis, this Flood Insurance Study supercedes the previously printed Flood Hazard Boundary Map for the City of Aurora (Reference 27).

7.0 LOCATION OF DATA

Survey, hydrologic, hydraulic and other pertinent data used in this study can be obtained by contacting the Office of the Natural and Technological Hazards Division, Federal Emergency Management Agency, 1371 Peachtree Street, N.E., Suite 736, Atlanta, Georgia 30309.

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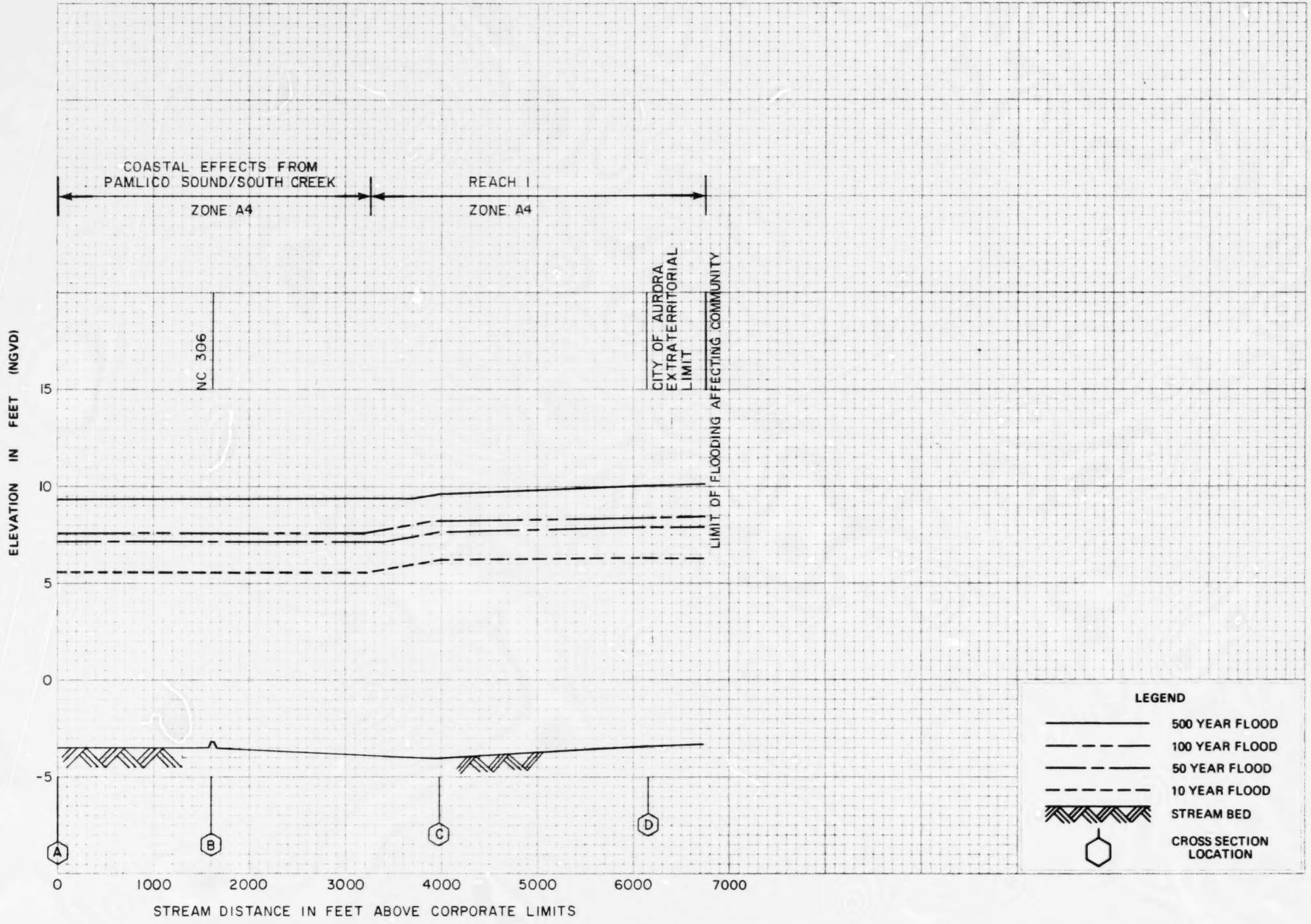

FLOOD PROFILES

BAILEY CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF AURORA, NC
(BEAUFORT CO)

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